IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application No.:	10/585,834
Applicant:	Patrick Le Bot
Filing Date:	July 12, 2006
Title:	CRYOGENIC DISTILLATION METHOD AND INSTALLATION FOR AIR SEPARATION
TC/A.U.:	3744
Examiner:	John F. PETTITT
Docket No.:	Serie 6485
Customer No.:	40582

APPEAL BRIEF

MAIL STOP APPEAL BRIEF - PATENTS
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

Applicant submits this Appeal Brief to the Board of Patent Appeals and Interferences in response to the Advisory Action, dated March 18, 2010 and Final Office Action, dated December 28, 2009, finally rejecting claims 9 - 12. The final rejection of claims 9 - 12 is appealed. This Appeal Brief is believed to be timely since electronically filed by the due date of June 28, 2010, as set by the mailing of a Notice of Appeal on April 28, 2010. Please charge the fee of **$540.00** for filing this brief to Deposit Account No. 01-1375, Attorney Docket No. Serie 6485.

The Commissioner is hereby authorized to charge any appropriate fees under 37 C.F.R. §§ 1.16, 1.17 and 1.21 that may be required by this paper and to credit any overpayment to Deposit Account No. 01-1375.

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Real Party in Interest

The present application has been assigned to L'Air Liquide, Société Anonyme à Directoire et Conseil de Surveillance pour l'Etude et l'Exploitation des Procédés Georges Claude, Paris, France. No other entity has an interest in the present application or appeal.

Related Appeals and Interferences

Applicant asserts that no other appeals or interferences are known to the Applicant, the Applicant's legal representative, or assignee which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

Status of Claims

Claims 9 - 12 are pending in the application. Claims 1 - 8 were originally presented in the application and were cancelled with a preliminary amendment. Claims 9 - 16 were added in the same preliminary amendment. Claims 13 - 16 were withdrawn, without traverse, during prosecution. Claims 9 - 12 stand finally rejected as discussed below. The final rejection of claims 9 - 12 are appealed. The pending claims are shown in the attached Claims Appendix.

Status of Amendments

All claim amendments have been entered by the Examiner. No amendments were proposed after the final rejection.

Summary of Claimed Subject Matter

This invention relates to a process and to an installation for separating air by cryogenic distillation. *See Application*, page 1, lines 4 – 6.

A. Claim 9 – INDEPENDENT

Claim 19 recites a process for separating air by cryogenic distillation in an installation comprising a double or triple air separation column of which one medium-pressure column operates at a medium pressure, and an exchange line (*See Application*, page 2, lines 4 - 9) in which: air is raised to a high pressure, wherein said high pressure is at least 5 bar above the medium pressure, and purified at the high pressure (*See Application*, page 2, lines 10 - 12); one portion of the stream of purified air is cooled in the exchange line and is then divided into two fractions (*See Application*, page 2, lines 13 - 15); each fraction is expanded in a turbine (*See Application*, page 2, line 16); the intake pressure of the two turbines are at least 5 bar above the medium pressure (*See Application*, page 2, lines 17 - 19); a delivery pressure of at least one of the two turbines is substantially equal to the medium pressure (*See Application*, page 2, lines 20 - 22); at least one portion of the air expanded in at least one of the turbines is sent to the medium-pressure column of the double or triple column (*See Application*, page 2, lines 23 - 25); a cold booster mechanically coupled to one of the expansion turbines takes in air, which has undergone cooling in the exchange line, and delivers the air at a temperature above an intake temperature of at least one of the turbines, and the air delivered by the cold booster is reintroduced into the exchange line in which at least one portion of the fluid undergoes pseudo-condensation (*See Application*, page 2, lines 26 - 32); at least one pressurized liquid coming from one of the columns undergoes pseudo-vaporization in the exchange line at a vaporization temperature (*See Application*, page 2, lines 33 - 35), and the turbine not coupled to the cold booster is coupled to a booster followed by a cooler (*See Application*, page 2, lines 37 - 38); and, the intake temperature of the cold booster is close to the pseudo-vaporization temperature of the liquid (*See Application*, page 3, lines 1 - 3), wherein said installation includes, in addition to the double

or triple column, a mixing column, and air coming from at least one of the turbines is sent to the mixing column, after having passed through the medium-pressure column (*See Application*, page 3, lines 5 - 9).

B. Claim 10 - DEPENDENT

Claim 10 further limits claim 9. Specifically, claim 10 further requires that the air sent to at least one of the turbines upstream of the mixing column comes from the booster, and leaves the booster at a pressure above the high pressure (*See Application*, page 3, lines 10 - 13)

C. Claim 11 - DEPENDENT

Claim 11 further limits claim 9. Specifically, claim 11 requires that the air expanded in at least one of the turbines is sent to the bottom of the mixing column, in order to participate in mass exchange therein. (*See Application*, page 3, lines 14 - 16)

D. Claim 12 - DEPENDENT

Claim 12 further limits claim 9. Specifically, claim 12 requires sending at least a portion of said air from said hot booster to said Claude turbine, wherein said air is sent at the outlet pressure of said hot booster. (*See Application*, page 3, lines 26 - 28)

Grounds of Rejection to be Reviewed on Appeal

1. Claims 9 – 11 (and presumably 12) stand rejected under 35 U.S.C. § 103 (a) as being unpatentable over Grenier (US 5,475,980) in view Grenier (US 5,735,142).

2. Claims 9 - 11 (and presumably 12) stand rejected under 35 U.S.C. § 103 (a) as being unpatentable over Mostello (US 5,379,598) in view Grenier (US 5,735,142).

Arguments

1. Claims 9 to 11 (and presumably 12) are not unpatentable under 35 U.S.C. § 103(a) over Grenier et al '980 in view of Grenier '142)

The Examiner notes that "the broadest reasonable interpretation of "mixing column" employed by the rejection (a column in which mixing may occur)" is reasonable. The Examiner further notes that citing from a secondary source such as a different patent is not sufficiently compelling to define the term "mixing column", and that Applicant must rely on the specification of the instant application in order to "be his own lexicographer".

Applicants respectfully point out that the term "mixing column" is a term of art well known and understood by one of ordinary skill in the art of cryogenic air separation. As ancillary evidence of this, Applicants provide the following in the attached Information Disclosure Statement::

"Separation Devices for Gas Mixing", Rakesh Agrawal and Jianguo Xu, 1995;

"ICO Developments or Low Purity Oxygen Manufacture", Colleen Prince and James Flaherty, 1995;

"Air Separation Design for IGCC – Future Directions", A.R. Smith and E.J. Noga, 1996;

"Optimized Steel Production with Oxygen for Blast Furnaces at ILVA, Taranto Works, Italy", L. Capogrosso, G. Zinno, and H. Gasser-Coze, 2003;

"Advanced Integration Concepts for Oxygen Plants and Gas Turbines in Gasification / IGCC Facilities", A.R. Smith, J. Klosek, and W. Woodward, 1996.

Applicants will also demonstrate this by citing the instant application. The Examiner notes that "providing a further column in which mixing may occur is also standard practice for the purpose of separating further components such as argon." The instant specification states, with reference to Figure 1, that "The column system of an air separation unit is formed by a medium-pressure column 100 thermally coupled with a low-pressure column 200 having a minaret, a mixing column 300, and an optional argon column (not illustrated)." (*page 7, lines 11 – 15*). The skilled reader would clearly see that Applicants are obviously distinguishing the "mixing column" from an "argon column".

Applicants had previously defined a mixing column as a "countercurrent contact column in which a more easily volatile gaseous fraction is sent opposite a more poorly volatile liquid." Referring to Figure 1, and the specification (*page 8, lines 19 – 30*), the

reader finds gaseous air (stream 122) being sent opposite of oxygen rich liquid (stream 35). The gaseous air stream is more easily volatile than the more poorly volatile oxygen rich liquid. The direct contact between these two streams of different volatility, results in the production of a gaseous oxygen stream (37) and a liquid bottom stream (41). Thus, this definition of a mixing column is substantiated by the instant specification.

In any case, one skilled in the art at the time that the present invention was made, would recognize that a *mixing* column, irrespective of any nuances in the definition, requires direct contact between two different streams. There must be mixing. The column identified in Grenier '142 as a 'mixing column' by the Examiner (column 31) does not mix any two streams together. There are only two inlet streams; the rich liquid from the HP column (stream 35) and the argon branch connection feed (stream 32). Applicants see no other inlet streams to column 31.

Grenier '143 clearly states that stream 35 enters "a condenser 34 in which rich liquid, expanded at 35 to near atmospheric pressure, is vaporized and then returned into the column 11 via a conduit 36." (column 4, line 66 – column 5, line 2). Hence they are not in contact. No mixing takes place, whether this is what one skilled in the art would recognize as a mixing column or not. Hence column 31 can not be a *mixing* column.

Hence Applicants maintain that the rejection as it pertains to claim 9 is improper. As claims 10 to 12 are dependent upon claim 9, the rejection is improper with respect to them as well.

In response to this, in the Advisory Action dated March 18, 2010, the Examiner states:

> "1. Applicant's arguments are that "mixing column" is a term of art that is readily understood to have a more specific meaning, the applicant attempts to support this by submitting references which employ the term "mixing column" In response to the applicant's arguments, the examiner disagrees that the evidence provided supports the conclusion that a mixing column is a term that must be interpreted to have the meaning that the applicant has outlined previously (a column in which a more easily volatile gaseous fraction is sent opposite a more poorly volatile liquid because no arguments have been provided showing that such a definition is supported by the references. The reader is left to guess as to why the applicant believes the references support their position and therefore the argument is unpersuasive. Further it is noted

that the references invariably explain what occurs in the column they have designated as a "mixing column" because simply stating that the column is a mixing column is not sufficient to convey that the column must have a specific mixing other than that the column has mixing.

2. Applicant's arguments are that the applicant's specification defines the term "mixing column" by discussing the use of a column as well as the use of an argon column and that such use of the term differentiates the mixing column as a column that is not the argon column. In response to the applicant's arguments, the examiner disagrees as the use of the term in discussing the column does not redefine the term mixing column. Though the specification describes two columns that are identified as a mixing column and an argon column this does not mean that the application has defined the term mixing column to be columns that are not argon columns. Especially considering that either column may be said to have mixing of fluids. The applicant has not redefined the meaning of mixing column to exclude columns operating with argon and therefore the argument is unpersuasive.

3. Applicant's arguments are that the applicant considers the broadest reasonable interpretation of the term "mixing column" to be a column in which a less volatile gas is sent opposite a more poorly volatile liquid and that there must be mixing within the column for the column to be considered a mixing column.

In response to the applicant's arguments, the examiner agrees that the claimed process requires that the mixing column must have mixing therein. The examiner further notes that assuming arguendo that the broadest reasonable interpretation espoused by the applicant is employed, it is noted that within the column (31) of Grenier (US 5,735,142) there is inherently some vapor that is counter currently flowing in contact with some liquid as gas portions of the feed fluid flow upward and liquid portions flow downward due definition of the applicant, Grenier (142) clearly teaches a mixing column and thereby the rejection is proper." to the cooling at the top of column (31). Therefore, even by the specific

With respect to 1), with all due respect to the Examiner, the Applicant is put in an impossible position, vis-à-vis the Examiner's arguments. In essence, the Examiner is stating

that if any publication produced simply uses the term "mixing column", without explanation, this merely refers to any column in which mixing occurs. However, if these publications use the term "mixing column" *with* an explanation of how this is a special term, by routinely providing this definition, they are indicating that this is not a well known term of art. Applicants reassert their position that the term "mixing column" is a term of art well known and understood by designers and process engineers that work in the area of cryogenic distillation.

With respect to 2), surely it is recognized that the term "argon column" is well known in the art as a special variation of a cryogenic air distillation column. Presuming as much, it should also be recognized by the skilled artisan that no true mixing takes place in an argon column.

"Mixing" is defined as "combining substances, elements, things, etc, into one mass, collection or assemblage, generally with a thorough blending of the constituents." (*Random House Unabridged Dictionar, Second Edition, 1993*). In a mixing column, for example, a stream of liquid oxygen is mixed with a stream of vaporous air. Two different substances are introduced into the column and co-mingled. While it is true that the more volatile elements will rise and the less volatile elements will fall, there is a zone in the mixing column in which two different streams, of two very different compositions are mixed. In an argon column, a single stream of enriched liquid is separated into an argon rich vapor and an argon poor liquid. This is separation, the exact opposite of mixing.

As is the column identified in Grenier '142 by the examiner as representing a "mixing column" (i.e. column 31, which is identified within the text as a column for separating out argon). Column 31 has one stream entering (stream 32, argon rich stream), and two streams exiting (stream 37, impure gaseous argon; stream 33, recycled argon deficient liquid). The only other stream entering column 31, is liquid oxygen stream 35, which provides refrigeration to the condenser (34), and exits as an at least partially vaporized oxygen stream 36. No mixing is taking place, and hence argon column 31, can not anticipate or render the present invention obvious.

With respect to 3), Applicant respectfully reminds the reader the following:

Basic air separation distillation column comprises a vaporizer at the bottom to warm the liquid (whereby the more volatile elements vaporize and rise through the column) and a condenser at the top to cool the vapor (whereby the less volatile elements condense and fall

through the column). A single stream to be distilled enters the column, and two streams leave (a vapor stream rich in the more volatile elements, and a liquid stream rich in the less volatile elements). In an air separation column, the inlet is liquid or gaseous air, the more volatile element is nitrogen, and the less volatile element is oxygen.

In a double column system, the oxygen rich liquid is the inlet stream, a nitrogen stream is the more volatile element, and a more pure oxygen stream is the less volatile stream. This more pure oxygen stream also contains a higher concentration of argon than atmospheric air.

An argon separation is simply by another distillation column, with the more pure liquid oxygen stream as the inlet stream, and the more volatile element being argon.

As previously noted, a mixing column is defined as a countercurrent contact column in which a more easily volatile gaseous fraction is sent opposite a more poorly volatile liquid. In a mixing column, an air stream is introduced at the bottom of the column, and an essentially pure liquid oxygen stream is introduced at the top. These two *streams of very different composition* come into direct contact, thereby producing a slightly lower purity gaseous oxygen stream, at pressure, without the need of a higher pressure air stream to provide the vaporization. A mixing column, in most cases, will have no vaporizer at the bottom and no condenser at the top. It is entirely different from an air separation column (and hence, an argon column), and is *not* simply a vessel that encourages mixing. It is a well defined and understood column, just as is the argon column, which typically needs no explanation either. In other words, the purpose of the mixing column is to provide direct contact heat transfer and vaporization.

The Examiner takes the position that, presuming there isn't any mixing of different inlet streams in column 31 of Grenier '131, that "there is inherently some vapor that is counter currently flowing in contact with some liquid as gas portions of the feed fluid flow upward and liquid portions flow downward due definition of the applicant". Applicants argue that this isn't *mixing*. It is separation by fractional distillation of a *single inlet stream*. As the rising vapor contacts the descending liquid it becomes richer in the more volatile components. It does not become a "collection or assemblage, generally with a thorough blending of the constituents" It becomes a more and more distinct component to the descending liquid. It is, indeed, the very opposite of mixing.

2. Claims 9 to 11 (and presumably 12) stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Mostello '598 in view of Grenier '142

The Examiner notes that "Mostello does not explicitly teach that the high pressure air is purified or a mixing column in which air from at least one of the turbines is sent." As discussed above, Grenier '142 fails to remedy this deficiency. Hence the rejection as it pertains to claim 9 is improper. As claims 10 to 12 are dependent upon claim 9, the rejection is improper with respect to them as well

Conclusion

In view of the above, it is believed that the Examiner's Final Rejection of the pending claims was not warranted and must therefore be REVERSED, together with a finding that the pending claims presented with this appeal are patentable.

Respectfully submitted,

Date: **June 23, 2010**

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Claims Appendix

Claims 1 – 8 (cancelled)

Claim 9 (previously presented): A process for separating air by cryogenic distillation in an installation comprising a double or triple air separation column of which one medium-pressure column operates at a medium pressure, and an exchange line in which:

a) air is raised to a high pressure, wherein said high pressure is at least 5 bar above the medium pressure, and purified at the high pressure;

b) one portion of the stream of purified air is cooled in the exchange line and is then divided into two fractions;

c) each fraction is expanded in a turbine;

d) the intake pressure of the two turbines are at least 5 bar above the medium pressure;

e) a delivery pressure of at least one of the two turbines is substantially equal to the medium pressure;

f) at least one portion of the air expanded in at least one of the turbines is sent to the medium-pressure column of the double or triple column;

g) a cold booster mechanically coupled to one of the expansion turbines takes in air, which has undergone cooling in the exchange line, and delivers the air at a temperature above an intake temperature of at least one of the turbines, and the air delivered by the cold booster is reintroduced into the exchange line in which at least one portion of the fluid undergoes pseudo-condensation;

h) at least one pressurized liquid coming from one of the columns undergoes pseudo-vaporization in the exchange line at a vaporization temperature, and

i) the turbine not coupled to the cold booster is coupled to a booster followed by a cooler; and,

j) the intake temperature of the cold booster is close to the pseudo-vaporization temperature of the liquid,

wherein said installation includes, in addition to the double or triple column, a mixing column, and air coming from at least one of the turbines is sent to the mixing column, after having passed through the medium-pressure column.

Claim 10 (previously presented): The process of claim 9, in which the air sent to at least one of the turbines upstream of the mixing column comes from the booster, and leaves the booster at a pressure above the high pressure.

Claim 11 (previously presented): The process of claim 9, in which air expanded in at least one of the turbines is sent to the bottom of the mixing column, in order to participate in mass exchange therein.

Claim 12 (previously presented): The process of claim 9, in which air at least at the high pressure is sent to a bottom reboiler of the mixing column where it at least partially condenses before being sent to the double or triple column.

Claim 13 (withdrawn): An installation for separating air by cryogenic distillation, comprising:

a) a double or triple air separation column (100, 200), the column (100) of which, operating at the higher pressure, operates at what is called the medium pressure;

b) an exchange line (9);

c) means for raising all the air to a high pressure, above the medium pressure, and means for purifying it, optionally at this high pressure;

d) means for sending one portion of the purified air stream into the exchange line in order to cool it and means for dividing this cooled air into two fractions;

e) two turbines (17, 19) and means for sending one air fraction to each turbine;

f) means for sending at least one portion of the air expanded in at least one of the turbines to the medium-pressure column of the double or triple column;

g) a cold booster (23), means for sending air, preferably withdrawn from an intermediate point on the main exchange line, to the cold booster and means for sending air boosted in the cold booster into the exchange line at an intermediate point upstream of the withdrawal point;

h) means (500) for pressurizing at least one liquid coming from one of the columns, means for sending the at least one pressurized liquid into the exchange line, and means for expelling a vaporized liquid from the exchange line;

i) the cold booster is coupled to one of the turbines (19); and

j) the turbine (17) not coupled to the cold booster is coupled to a booster (5) followed by a cooler,

wherein said installation includes a mixing column and means for sending air to the mixing column from at least one of the turbines (17, 19).

Claim 14 (withdrawn): The installation of claim 13, which includes means for sending one portion of the air compressed in the booster (5) constituting the energy dissipation means, or

forming part of the latter, to at least one expansion turbine (17, 19) upstream of the mixing column.

Claim 15 (withdrawn): The installation of claim 13, which includes means for sending air, coming from at least one of the turbines (17, 19), into the mixing column in order to participate in mass exchange therein.

Claim 16 (withdrawn): The installation of claim 13, which includes means for sending air (123) at least at the high pressure into a bottom reboiler (301) of the mixing column (300) and means for sending air at least partially condensed in this bottom reboiler to the double or triple column.

Evidence Appendix

None.

Related Proceedings Appendix

None.